

Optical effects of Birefringent layers in top- and bottom emitting OLEDs

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Organic Light Emitting Diodes (OLEDs) are rapidly introduced in mainstream electronic devices and finally experience the widespread adoption that had been predicted by its enthusiasts. This development is fuelled by the superior display characteristics such as contrast, color rendering and viewing angle on the one hand and by their attractive form-factor on the other hand. This form-factor is enabled by the nanometer scale of the layer thicknesses that make up these devices.

These nanometer-scale allows for a precise control of the radiation that is generated in the emitting layer(s). The optical design of these stacks requires detailed knowledge of the complex refractive indices of the layers and their corresponding thicknesses. Historically, refractive indices of small organic molecule materials are considered to be isotropic or have negligible anisotropy. Yokoyama et al. showed that strong optical anisotropy can be observed in small molecule organic materials when they are deposited by thermal evaporation [1]. In addition to this, the optical anisotropy can be tuned and even reversed by controlling the deposition conditions [2].

Recently, we published guidelines on how to use anisotropic layers to enhance the outcoupling efficiency of bottom-emitting devices [3] and filed a patent based on these findings [4]. In this talk we will expand on the optical properties of bottom-emitting devices and on the use of anisotropic layers. In addition to this, we put forward guidelines for the use of anisotropic layers in top-emitting devices. We demonstrate the impact of anisotropic layers on both the outcoupling efficiency and the directional emission of OLEDs.

Reference

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